

REMARKS

Applicant respectfully requests reconsideration of the present application in view of the foregoing amendments and in view of these remarks.

In the specification, the abstract has been amended.

Claims 1-3, 11, 23, and 25-28 are revised. Claim 29 is added. No new matter has been added, with support for these changes found throughout the specification as originally filed. Thus, support for amended claim 1 is found in paragraph 18 of the published specification, US 2006/0142515, and for new claim 29 in original claim 11.

Upon entry of this response, claims 1-18 and 29 will be pending in this application, with claims 19-28 withdrawn from consideration.

As an initial matter, amendments have been made to both the Abstract and claim 3, as required by the Examiner's objections. Withdrawal of the objections is respectfully solicited.

I. Claim Rejections Under 35 U.S.C. § 112

Claim 3 stands rejected for alleged indefiniteness in reciting mutually exclusive limitations. The present revision to claim 3 clarifies the types of aliphatic, cycloaliphatic, and aromatic groups from which R^{1-6} are selected. Accordingly, Applicant submits that the grounds for this rejection are moot.

In this vein, claim 11 also stands rejected for the perceived use of a broader qualification within a narrower one. Applicant respectfully directs the Examiner's attention to amended claim 11, in which the broad limitation has been deleted and is restated in claim 29. Applicant believes such revision to obviate the stated ground for this rejection.

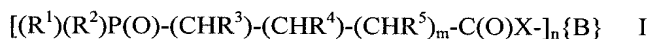
In view of the foregoing, Applicant respectfully requests withdrawal of the noted rejections.

II. Claim Rejections Under 35 U.S.C. § 102

Claims 1 and 5-9 are rejected for alleged anticipation by U.S. 6,242,433 to Balsamo *et al.*, particularly in its disclosure of “compound 6.” Office Action, page 4. Applicant respectfully traverses this rejection.

Applicant believes that the Examiner intended to cite compound 5 of Balsamo, since compound 6 contains a COOH group, which is not a possible substituent for R⁴ presently. Thus, claim 1 now recites, in relevant part:

A compound of the formula (I)



in which the substituents and indices have the following meanings:

X is O, NH, NR⁶ or S,

R¹ and R² are, independently of one another, hydrogen or optionally substituted alkyl, alkenyl, aryl, alkylaryl or arylalkyl or optionally substituted alkoxy, alkenyloxy, aryloxy, alkylaryloxy or arylalkyloxy,

R³, R⁴, R⁵ and R⁶ are, independently of one another, hydrogen or optionally substituted alkyl, alkenyl, aryl, alkylaryl, arylalkyl or hydroxy,

{B} is a straight-chain or branched substituent with (i) more than one organically polymerizable group that contains a C=C moiety, (ii) at least 2 carbon atoms, and no silicon atoms,

m is an integer from 0 to 20,

n is an integer from 1 to 20;

apart from compounds in which {B} exhibits one or more isolated or oligomerized isoprene groups.

(Emphasis added.)

In contrast to the highlighted proviso, compound 5 and Balsamo's other compounds include one or more isolated or oligomerized isoprene groups; that is, a $-\text{((CH}_3\text{)C=CHCH}_2\text{CH}_2\text{)}-$ backbone. Since the proviso of claim 1 excludes such compounds, Balsamo cannot anticipate Applicant's claimed invention. Applicant therefore requests withdrawal of the rejection over Balsamo.

III. Claim Rejections Under 35 U.S.C. § 103

Claims 1 and 5-18 stand rejected over the combination of U.S. 4,514,342 to Billington *et al.* with WO 00/58316 (equivalent to U.S. 6,458,868) to Okada *et al.* and WO 02/02057 (equivalent to U.S. 6,902,608) to Erdmann *et al.* Applicant submits, however, that the present claims do not read on and are not presaged by the posited combination of references. Furthermore, combining Okada with either or both of Billington and Erdmann runs contrary the teachings of these references. Accordingly, a *prima facie* case of obviousness has not been established under Section 103.

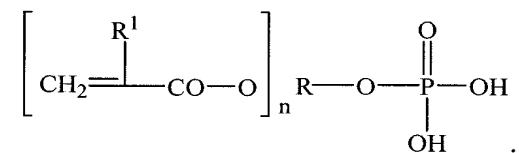
The presently claimed invention is directed to phosphonates of formula I:
 $[(\text{R}^1)(\text{R}^2)\text{P}(\text{O})-(\text{CHR}^3)-(\text{CHR}^4)-(\text{CHR}^5)_m-\text{C}(\text{O})\text{X}-]_n\{\text{B}\}$. The structure contains a carbonyl group next to X, which may be O, NH, NR^6 , or S. In the present compounds and the prior-art compounds alike, there is a specific orientation to the ester, amide, or thioester group that is formed. In relation to forming Applicant's claimed compounds, the phosphorus-containing residue is part of the acid component of the ester or amide, while the {B} component is part of the alcohol, thiol, or amine component. The result is a phosphonate having an orientation of the ester as a $-\text{O}(\text{O})\text{C}-\text{R}-\text{P}$. By contrast, Billington teaches phosphate compounds and does *not* teach such an orientation of an ester, but rather the exact opposite orientation.

The skilled person would understand that esters, thioesters, and amides are formed by the reaction of a carboxylic acid with an alcohol, thiol, or amine, respectively. There is a particular orientation of the ester to the groups that were present on the respective acids, alcohols, thiols, and amines. The fact that one particular orientation may be formed is not indicative that the

reverse orientation may be formed. This is the case of the presently claimed compounds, relative to those of Billington.

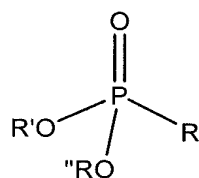
Billington

Billington is directed to adhesion promoters, specifically for the adhesion of dental materials to natural teeth. Col. 1, lines 6-9. The compounds upon which Billington relies have a general structure of:

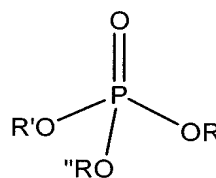


Col. 3, lines 21-27. In this structure, the phosphate has an ester that is oriented in a $-\text{C}(\text{O})\text{O}-\text{R}-\text{P}$ fashion. Furthermore, Billington requires that “n is an integer of *at least* 3.” Col. 3, line 36. All the examples comport with n as an integer of at least 3, by showing compounds such as pentaerythritol triacrylate phosphate (Example 1), pentaerythritol trimethacrylate phosphate (Example 2), and dipentaerythritol triacrylate phosphate (Example 3). The compounds of Billington do not implicate and are not encompassed by the presently claimed invention, for several reasons.

As alluded to above, the present application is concerned with phosphonates and Billington is concerned with phosphates. Those of skill in the art readily understand that these are distinct compounds, one from the other, with distinct synthetic origins. Phosphonates have the general structure (A), whereas phosphates have the general structure (B):



(A)



(B)

The difference is apparent - the presence of a P-R group versus a third P-OR group – and would have confounded *a priori* generalization from one compound to the other. This fact alone is sufficient to defeat an obviousness rationale informed by Billington.

As the Examiner has himself noted, however, Billington also does not teach a spacer between the polymerizable groups and the phosphate. Instead, the Examiner relies upon Okada for this feature. Addressed below, Okada fails not only to suggest structurally relevant compounds but also to remediate other failings of Billington, certainly omitting any suggestion of the claimed compounds.

Thirdly, the Examiner will note that the -C(O)O- group of Billington is in the opposite orientation of the -O(O)C- group of the present claims, where X is O. This is due to a significant preparative difference between Billington and the instant application. As remarked above, where X is O, the present application entails preparing the compounds from molecules in which the phosphonate residue is part of the acid component of the ester, while the {B} component is part of the alcohol component. Conversely, in Billington the phosphate residue is generated from phosphorous oxychloride and the acrylate moieties are added via a alcohol group such as pentaerythritol triacrylate (see Example 1). The synthetic procedure of Billington will only result in the production of phosphates, not the presently recited phosphonates.

Fourthly, the R radical of Billington needs to be bound to at least three acrylate residues, because n is at least 3. One of skill in the art will immediately recognize that this will require R to comprise at least four carbon atoms (*i.e.*, n+1), and according to the examples R may be a pentaerythritol or a dipentaerythritol group. Col. 4, line 35 and lines 47-49. To bring this into

concordance with the presently claimed invention, R³ and R⁴ would have to be R-C(O)O- groups. Yet, such groups are not recited in the Markush group from which R³ and R⁴ are selected, *i.e.*, hydrogen or optionally substituted alkyl, alkenyl, aryl, alkylaryl, arylalkyl or hydroxy.

In light of these considerations and the Examiner's own reasoning why the present claims do not encompass Billington, the reference evidences no motivation for the skilled artisan to have obtained the compounds of the present claims

Okada

The Examiner has invoked Okada to remedy the failings of Billington. Yet, notwithstanding his assertion that both Okada and Billington deal with dental materials (Office Action, page 5), the Examiner in essence validates modification of an apple in view of an orange, since Okada and Billington teach non –overlapping compound groups, phosphonates versus phosphates, respectively. For the reasons enumerated above, the Okada compounds and the Billington compounds are distinct structurally and not comparable. Thus, it is improper under Section 103 to modify the compounds of Billington in view of the compounds of Okada.

Okada's teachings diverge significantly from the present invention in other aspects, further belying the alleged *prima facie* case of obviousness. For instance, Okada deals only with compounds having a single polymerizable moiety. Conversely, the presently claimed invention recites, in part, “{B} is a straight-chain or branched substituent with (i) *more than one organically polymerizable group* that contains a C=C moiety, (ii) at least 2 carbon atoms, and no silicon atoms” (emphasis added).

Furthermore, Okada differs from the present invention in the methodology used to prepare the compounds of interest. Okada forms the phosphonate compounds via a complicated reaction scheme in which a diol is first esterified with methacrylic acid, followed by esterification with 2-carboxyethylphosphonate in order to obtain compounds such as 5a. See Okada example 8-1, col. 42. The 2-carboxyethylphosphonate itself is only obtainable through a

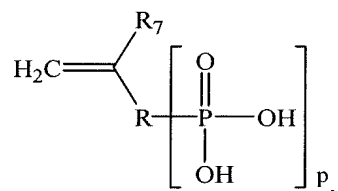
multi-step procedure starting from triethylphosphite and β -propiolactone. See also Okada example 8-1. As noted above, on the other hand, the present application utilizes a reaction between the phosphonate carboxylic acid with an alcohol, thiol, or amine.

Erdmann

The Examiner also cites to Erdmann as teaching that alkyl chains between a phosphonic acid and double bond have a high resistance to hydrolysis. Office Action, page 6. Erdmann states that:

The invention is based on the surprising discovery that molecules with a relatively long chain bridge between phosphonic acid group and reactive double bond, as defined in the claim, have a high resistance to hydrolysis and, at the same time, improved adhesive properties.

Col. 2, lines 20-24. To meet this objective, Erdmann proposes compounds of the following formula:



Col. 1, lines 37-35. Each of the choices provided for R are either inapposite to the claimed invention (i.e. no ester/amide group) or have the reverse ester/amide orientation, from which Billington suffers. Again, the compounds of Erdmann are phosphonate compounds and therefore not comparable to the phosphates of Billington. For the skilled artisan, the combination of Erdmann with Okada still would fall short of showing each and every element of the claimed invention. Elements lacking would at least be the “one or more organically polymerizable groups,” and a synthetic procedure conducive to the production of the claimed compounds. Thus, even the combination of Erdmann and Okada falls short of the establishment of a *prima facie* case of obviousness.

Summary of § 103 arguments

To summarize, the presently claimed invention is directed to phosphonate compounds in which an ester is formed from an acid having a phosphonate moiety and an alcohol, thiol, or amine. In the simplest explanation, Billington teaches phosphates, which are not the same or suggestive of the claimed phosphonate compounds. Billington suffers a number of other failings: no spacer, improper ester orientation to the phosphorus containing moiety, and synthetic procedures that cannot yield the structural features of Applicant's claimed invention. Okada also fails to suggest the elements of the claimed invention, and the reference would not have motivated, via described synthetic procedures, the preparation of the presently claimed compounds. Erdmann simply fails to teach structurally relevant compounds.

In view of the fact that Billington, Erdmann, and Okada either cannot be combined for lack of teaching structurally related compounds, or when combined fail to teach each and every element of the present claims, Applicant submits that a *prima facie* case of obviousness has not been established. Applicant therefore requests that the Examiner withdraw the noted rejections and allow the application to move to issuance.

IV. Request for Rejoinder of Claims

In making the requirement for restriction final, the Examiner states that the compound of claim 1 was shown in the cited art of Balsamo. Since claim 1 is now free of the art, Applicant submits that formula (I) embodies a special technical feature that ties together each of the proposed groups of claims. Thus, the Examiner's grounds for imposition of the finality of the restriction are overcome. Appropriate amendments have been made to bring claims 19-28 into concert with revised claim 1. Accordingly, Applicant requests that Groups II and III be rejoined to the present application, and allowed to move forward to issuance with the present application.

Applicant believes that the present application is now in condition for allowance.
Favorable reconsideration of the application as amended is respectfully requested. Examiner
Heincer is invited to contact the undersigned directly, should he feel that any issue warrants
further consideration.

Respectfully submitted,

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